

B 35448-000A

N 84 - 23418



National Space Science Data Center/
World Data Center A For Rockets and Satellites

83-17

DOCUMENTATION FOR THE MACHINE-READABLE VERSION

OF THE

SAO-HD-GC-DM CROSS INDEX

VERSION 1983



DECEMBER 1983

DOCUMENTATION FOR THE MACHINE-READABLE VERSION

OF THE

SAO-HD-GC-DM CROSS INDEX

VERSION 1983

Nancy G. Roman, Wayne H. Warren Jr. and Norman J. Schofield Jr.

December 1983

National Space Science Data Center (NSSDC)/
World Data Center A for Rockets and Satellites (WDC-A-R&S)
National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

DOCUMENTATION FOR THE MACHINE-READABLE VERSION

OF THE

SAO-HD-GC-DM CROSS INDEX

VERSION 1983

ABSTRACT

An updated and extended machine-readable version of the catalog is described in detail. In addition to the correction of all errors found since preparation of the original catalog (Morin 1973, Obs. de Meudon, unpublished), most of which resulted from misidentifications and omissions of components in multiple-star systems and missing Durchmusterung numbers (the common identifier) in the SAO Catalog, component identifications from the *Index of Visual Double Stars* (IDS) have been appended to all multiple SAO entries having the same DM numbers, and lower case letter identifiers for supplemental BD stars have been added. A total of 11,398 individual corrections and data additions has been incorporated into the present version of the cross index.

TABLE OF CONTENTS

Section 1 - INTRODUCTION AND PROCEDURE	1-1
Section 2 - TAPE CONTENTS	2-1
Section 3 - TAPE CHARACTERISTICS	3-1
Section 4 - REMARKS, ACKNOWLEDGMENTS AND REFERENCES	4-1
Section 5 - SAMPLE LISTING	5-1

LIST OF TABLES

Table

1 Tape Contents	2-1
2 Explanation of HD Codes	2-2
3 Tape Characteristics	3-1
4 Sources for Changes in the <i>SAO-HD-GC-DM Cross Index</i>	4-1
5 Explanatory Notes to Individual Changes	4-2

SECTION 1 - INTRODUCTION AND PROCEDURE

INTRODUCTION

A *Table of Correspondences* among the numbering systems of the *Smithsonian Astrophysical Observatory Star Catalog* (SAO, Smithsonian Astrophysical Observatory Staff 1966), *The Henry Draper Catalogue* (HD, Cannon and Pickering 1918-1924), the *Albany General Catalogue* (GC, Boss 1937) and the various *Durchmusterung* catalogs (DM [BD, SD, CD, CPD] see Fernandez, Lortet and Spite 1983 for references) was prepared by Morin (1973) by computer cross-identification of SAO stars with the HD (via DM numbers) and the GC (via HD numbers). The SAO does not, however, distinguish among components of multiple stars and between primary or supplemental entries in the *Bonner Durchmusterung*; thus, there are often two (occasionally three) stars in the SAO having identical DM numbers. Since the cross index was prepared by computer, the HD and GC numbers were frequently assigned to the wrong components. The current version of the *SAO-HD-GC-DM Cross Index* remedies this problem and corrects as many other errors as we could find, plus a number of errors kindly forwarded to us by various SAO Catalog users.

This document describes the new version of the *SAO-HD-GC-DM Cross Index*. It is intended to provide a description of the procedures used to correct and augment the previous version and to enable users to read and process the data without problems or guesswork. The following section outlines the methods used to cross identify the stars and to add the component identifications. Section 2 provides a detailed description of the catalog format, while Section 3 contains information on the characteristics of the magnetic tape file. Miscellaneous remarks and bibliographical references are given in Section 4, and a sample listing of data records comprises Section 5. A copy of this document should be distributed with any machine-readable copy of the catalog.

PROCEDURE

As a first step, all SAO entries having duplicate DM numbers were selected from the SAO Catalog and written to a separate file. Using the SAO positions, separations and position angles were computed for all duplicate DM entries in all possible ways, e.g. A with respect to B and B wrt A (at this point, component letters had not been assigned). Multiple systems were then identified in the *Index Catalogue of Visual Double Stars* (IDS, Jeffers et al. 1963; Worley 1980) and component identifications assigned according to that catalog. For stars not in the IDS, components were labeled according to visual magnitude. Supplemental BD stars were identified by cross indexing to the catalog of Warren and Kress (1980) and confirming with SAO and precessed BD positions. A few duplicate DM numbers actually referred to the same star for which SAO data had been obtained from different source catalogs. In these cases, cross references were deleted for one entry, normally for the one whose position was judged to be less accurate in the SAO. However, the data records have been retained and the deleted entries (blank data) indicated by placing

a "D" immediately following an SAO number. A similar procedure was followed for stars whose entries have been deleted in the SAO Catalog itself.

In the southern hemisphere, many stars occur in two DM catalogs (CD, CPD). For some double stars, the SAO gives the numbers from different catalogs for the two components; thus, for these stars, there are no duplicate DM numbers, but the same component confusion can occur. Although a search for such systems was not exhaustive, the catalog was searched for adjacent entries with numbers from DM catalogs and declinations within 3' of each other. Most of these proved to be double stars and were labeled with letter designations as if they had had the same DM numbers, i.e. the DM numbers were not changed, but the letter designations for the components were merely added.

Once the components of double and multiple systems had been correctly identified, the HD and GC catalogs were checked manually to be certain that the correct numbers in these catalogs were assigned to each component. The catalog was then scanned visually for HD and GC numbers which appeared to be out of order. In this way, a number of cases of confusion between numbers in the southern catalogs was found and corrected. The HD and GC numbers were corrected appropriately for double-star components.

An important subset of rather bright stars in the published SAO Catalog has no DM numbers given. (Most of the stars in this subset were identified as FK3 double stars which were omitted from FK4.) Many of these stars had been identified by W. L. Stein, who supplied probable DM numbers. The positions for these stars were compared manually with their positions in the various DM catalogs and many additional identifications were made.

Although the *Henry Draper Extension* (HDE, Cannon 1925-1936) stars from *Harvard Annals*, Volume 100, having DM numbers listed in the original catalog, were included in the Cross Index, those listed with AG numbers only (Astronomische Gesellschaft, zones +50° to +54°, Harvard, Rogers 1892; zones +55° to +59°; Helsingfors-Gotha, Krüger 1890) had not been cross identified to the SAO. The *Yale Zone Catalogues* (YZ, Barney et al. 1959, 1959a) which identify stars by their AG numbers, but also give corresponding DM numbers, were used to cross identify the AG stars. This was accomplished by using the magnetic tape versions of the YZ and HD catalogs and matching the stars by machine. A cross index of *Henry Draper Extension* (HDE, Cannon and Walton Mayall 1949) stars from *Harvard Annals*, Volume 112 and DM numbers (Bonnet 1978) was used to insert HDE numbers from the final HD volume.

Since the GC numbers in the cross index had been assigned by comparing HD numbers in the GC, stars without HD numbers in the cross index had missing GC numbers. The magnetic tape file of the GC was therefore searched by DM number for all stars having no GC numbers in the Cross Index. Additional GC numbers were found manually (by position) for GC stars not originally identified in the Cross Index and for the few remaining stars without DM numbers. Fourteen GC stars were found not to be in the SAO Catalog. HD numbers in the GC were then compared with their counterparts in the Cross Index for stars in common, leading to the detection and correction of a number of additional errors.

The Cross Index contains a numerical code appended to each HD number. The code originally followed the convention of the *Strasbourg Catalog of Stellar Identifications* (CSI, Ochenbein et al. 1981) which assigned the numbers 1, 2,... for individual components of multiple systems and the digit 9 if two contiguous HD stars are included in the entry (the lower HD number is given with code 9). Since the component codes were assigned to CSI entries without regard to letter designations, and because letter designations have now been added, the HD code was changed to a consistent indication of major contamination of the spectral type of the particular component to which the entry applies by the spectrum of another star (see Table 2). A visual magnitude difference of 0.3 was used as the limit for which contamination was indicated. Although photographic magnitudes would have been more appropriate, the visual magnitudes in the SAO appeared to be more consistent.

A total of 8600 cross index records has been corrected or augmented with component and supplemental BD designations.

SECTION 2 - TAPE CONTENTS

A byte-by-byte description of the contents of the machine-readable *SAO-HD-GC-DM Cross Index* is given in Table 1. The suggested format specifications apply to FORTRAN formatted read statements and can be modified depending upon individual programming and processing requirements. All data fields with primary A-format specifications are blank for missing data; hence the alternate numerical specifications used for machine searches will produce zero values. Alternate format specifications are given in parentheses.

Table 1. Tape Contents. *SAO-HD-GC-DM Cross Index*.

Byte(s)	Suggested Format	Description
1- 6	I6	Number in the SAO Catalog. This number is the key to the records, i..e. the file is ordered by SAO number.
7	1X	Blank
8-13	A6 (I6)	Number in the HD catalog or its extensions (HDE).
14	1X	Blank
15	A1 (I1)	HD code (see Table 2 for descriptions of the codes).
16	1X	Blank
17-21	A5 (I5)	Number in the GC catalog.
22-23	A2	Identification of the DM catalog for which the following number is given (BD <i>Bonner Durchmusterung</i> or its southern extension; CD <i>Cordoba Durchmusterung</i> ; CP <i>Cape Photographic Durchmusterung</i>).
24	A1	Sign of DM zone.
25-26	A2 (I2)	DM zone.
27-31	A5 (I5)	DM number.
32-33	A2	Component identification(s) for double or multiple systems (A,B,AB,...) assigned according to precepts outlined in Section 1.
34	A1	Lower case letter (a,b,...) to designate that the given BD number is a supplemental (footnoted) entry.

Table 2 gives a description of each HD code that can occur in byte 15 of a data record.

Table 2. Explanation of HD Codes.

Code(s)	Meaning
0	Single star, or companion >0.3 (visual) fainter than the primary to which the entry refers.
1	Brighter component with a companion <0.3 fainter.
2	Fainter component with a companion <0.3 brighter.
9	The SAO Catalog entry refers to two consecutive HD numbers, the lower of which is given.

SECTION 3 - TAPE CHARACTERISTICS

The information in Table 3 is sufficient for a user to describe the indigenous characteristics of the *SAO-HD-GC-DM Cross Index* to a computer. Information easily varied from installation to installation, such as block size (physical record length), blocking factor (number of logical records per physical record), total number of blocks, tape density, number of tracks, and internal coding (EBCDIC, ASCII, etc.) is not included. These parameters should always be transmitted if secondary copies of the catalog are supplied to other users or installations.

Table 3. Tape Characteristics. *SAO-HD-GC-DM Cross Index*.

NUMBER OF FILES	1
LOGICAL RECORD LENGTH (BYTES)	34
RECORD FORMAT	FB*
TOTAL NUMBER OF LOGICAL RECORDS	258997

* Fixed block length (last block may be short)

SECTION 4 - REMARKS, ACKNOWLEDGMENTS AND REFERENCES

The individual data corrections, additions and changes included in this version of the *SAO-HD-GC-DM Cross Index* number 11,398, with 8600 (3.3%) records having at least one change. Since many of the changes involve corrections to data given in previously published catalogs, it is important for a user to be able to refer to the individual changes if a discrepancy is found between this catalog and a previously published one. For this reason, we have prepared a complete table of all changes made to the original version (Morin 1973). The table was prepared by comparing the original *Table of Correspondences* with the complete revised Cross Index by computer. The resulting table is given on the microfiche cards contained in the envelope inside the back cover of this document. If a data entry is blank in either version, it is blank for the corresponding item in the table. The column labeled "S" gives the source of the change, as defined by its numerical code in Table 4.

Table 4. Sources for Changes in the *SAO-HD-GC-DM Cross Index*.

Code	Source(s)
1	Haramundanis, K., <i>Errata Sheet for the SAO Star Catalog</i> (undated) <i>Note on SAO Catalog Errata</i> (January 1971).
2	Stein, W. L. and Rudisill, J. C. 1977, <i>Introduction to the Dahlgren General Catalog</i> , Naval Surface Weapons Center NSWC/DL TR-3607. Stein, W. L. 1978, in Bischoff, M., <i>Bull. Inf. Cent. Données Stellaires</i> , No. 14, 2; No. 15, 103. Stein, W. L., private communications.
3	Bischoff M. 1978, <i>Bull. Inf. Cent. Données Stellaires</i> , No. 14, 2; No. 15, 103.
4	Hoffleit, D., private communication.
5	Parsons, S. B. 1977, <i>Bull. Inf. Cent. Données Stellaires</i> , No. 12, 41.
6	Nagy, T. A. 1979, <i>Documentation for the Machine-Readable Version of the Smithsonian Astrophysical Observatory Catalog</i> [ue] (EBCDIC Version), Systems and Applied Sciences Corporation R-SAW-7/79-34.
7	Houziaux, L. and Blondelot-Lickes, J. 1970, <i>Centre Univ. Mons, Fac. Sci., Dép. Astrophys., Communication No. 13.</i>

Table 4. (continued)

Code	Source(s)
8	Stoy, R. H. 1968, <i>Cape Photographic Catalogue for 1950.0, Zones -80° to -90°, Ann. Cape Obs. 22</i> (London: Her Majesty's Stationery Office).
9	McLaughlin, S. F., private communication.
10	Bonnet, R. 1978, <i>Cross Identifications of HDE Stars, Bull. Inf. Cent. Données Stellaires</i> , No. 15, 115. Magnetic tape version, CDS Strasbourg catalog number 4008.
11	Warren, W. H. Jr. and Kress, K. 1980, <i>Catalog of Supplemental Stars to the Bonner Durchmusterung</i> , <i>Astron. Data Center Bull.</i> <u>1</u> , 19.
12	Errors and Additions from the present work.
13	Schmidtke, P.C., private communication.
14	Herald, D. 1979, <i>Occultation Newsl.</i> <u>2</u> , 49.

Table 5 includes further notes on entries in the microfiche table for which additional explanations are considered useful to clarify the reasons for certain changes.

Table 5. Explanatory Notes to Individual Changes

SAO	Note(s)
6404	The GC incorrectly identifies this star as BD+76° 309; GC 11190 is BD+76° 309, while this star is +77° 309.
9949	This star is misidentified as BD+70° 1162 in the GC, as it is in the IDS and ADS (Aitken 1932). Source 3 corrects the DM number to +70° 1161, assuming that the double entry for +70° 1161 represents the two components of the double star. This is not the case. SAO 9949 is a duplicate entry and should be deleted.
15097	The GC incorrectly lists this star as BD+65° 761. It is actually +65° 751, while +65° 761 is SAO 15120, which does not appear in the GC.

Table 5. (continued)

SAO	Note(s)
17589	The GC incorrectly identifies this star as BD+68° 936; it is actually +69° 936.
23221	Source 1 incorrectly gives this star as BD+53° 508, while source 3 identifies it as BD+53° 568a. It is actually +52° 568a.
24753	This star is listed as BD+57° 825 in several catalogs. It is not in the proper position for the BD star, however. There is a star at the SAO position on photographs, but which is not in the BD.
29370 29372	These corrections are probably in error. The BD gives +54° 1724 as being SW of +54° 1725 and lists both stars as magnitude 7.5. The SAO, AGK3 and IDS list the brighter star ($\Delta m \sim 0.6$) as SE. The HD also lists the brighter star as south, but gives the same right ascension for both stars. The IDS identifies the brighter star as BD+54° 1724, as do the HD and the SAO, but the AGK3 reverses the DM numbers, listing the brighter star as +54° 1725.
101858	Sources 2 and 3 suggested changing this star to BD+17° 2945. It is part of a triple system, of which C, the fainter, more distant component, is +17° 2945. SAO 101858 and 101859 appear to be the A and B components, respectively, of +17° 2946.
238176	The GC is in error. GC 14513 is CP-54° 3795 and is not in the HD. GC 14517 is CP-54° 3797, which is HD 91593.

ACKNOWLEDGMENTS

We wish to express our appreciation to D. Hoffleit, S. F. McLaughlin, P. C. Schmidtke and W. L. Stein for communicating errors. The lists of Drs. Hoffleit and Stein were extensive and contained extremely valuable descriptive information which either solved the problems or helped with their analyses. We also gratefully acknowledge the assistance of B. G. Corbin and J. DeYoung of the U.S. Naval Observatory for making certain catalogs available and for providing information concerning an obscure reference, respectively.

REFERENCES

- Aitken, R. G. 1932, *New General Catalogue of Double Stars within 120° of the North Pole*, Carnegie Institution of Washington Pub. 417 (Washington: Carnegie Institution of Washington).
- Barney, I., Hoffleit, D. and Jones, R. B. 1959, *Catalogue of the Positions and Proper Motions of 8380 Stars Between Declinations +50° and +55°, reduced without applying Proper Motions to the Equinox 1950.0*, *Trans Astron. Obs. Yale Univ.* 26, Part II.
- Barney, I., Hoffleit, D. and Jones, R. B. 1959a, *Catalogue of the Positions and Proper Motions of 8164 Stars Between Declinations +55° and +60°, reduced without applying Proper Motions to the Equinox 1950.0*, *Trans Astron. Obs. Yale Univ.* 27.
- Bonnet, R. 1978, *Bull. Inf. Cent. Données Stellaires*, No. 15, 115.
- Boss, B. 1937, *General Catalogue of 33342 Stars for the Epoch 1950*, Carnegie Institution of Washington Pub. 468 (Washington: Carnegie Institution of Washington).
- Cannon, A. J. 1925-1936, *The Henry Draper Extension*, *Ann. Astron. Obs. Harvard College* 100.
- Cannon, A. J. and Pickering, E. C. 1918-1924, *The Henry Draper Catalogue*, *Ann. Astron. Obs. Harvard College* 91-99.
- Cannon, A. J. and Walton Mayall, M. 1949, *The Henry Draper Extension, The Annie J. Cannon Memorial Volume*, *Ann. Astron. Obs. Harvard College* 112.
- Fernandez, A., Lortet, M.-C. and Spite, F. 1983, *The First Dictionary of the Nomenclature of Celestial Objects*, *Astron. Astrophys. Suppl.* 52, No. 4.
- Jeffers, H. M., van den Bos, W. H. and Greeby, F. M. 1963 *Index Catalogue of Visual Double Stars, 1961.0*, *Pub. Lick Obs.* 21.
- Krüger, A. 1890, *Zonenbeobachtungen der Sterne zwischen 55° and 65° nord. Decl. angestellt an der Sternwarten von Helsingfors und Gotha. I Band, Inhalt d. Zonen 1-338 nebst den mittleren Oertern der Sterne für 1875* (Helsingfors: Kaiserl. Alexanders-Universität).
- Morin, D. 1973, *Table of Correspondences SAO/HD/DM/GC*, *Obs. de Meudon*, unpublished.
- Ochsenbein, F., Bischoff, M. and Egret, D. 1981, *Astron. Astrophys. Suppl.* 43, 259.

Rogers, W. A. 1892, *Catalogue of 8627 Stars*, *Harv. Ann.* 15, Part II.

Smithsonian Astrophysical Observatory Staff 1966, *Star Catalog. Positions and Proper Motions of 258,997 Stars for the Epoch and Equinox of 1950.0*, Pub. of the Smithsonian Institution of Washington, D.C. No. 4652 (Washington: Smithsonian Institution).

Warren, W. H. Jr. and Kress, K. 1980, *Astron. Data Center Bull.* 1, 19.

Worley, C. E. 1980, *Bull. Inf. Cent. Données Stellaires*, No. 18, 20.

SECTION 5 - SAMPLE LISTING

The sample listing given on the following pages contains logical data records exactly as they are recorded on the tape. Groups of records from the beginning and the end of the catalog are illustrated. The beginning of each record and bytes within the record are indicated by the column heading index across the top of each page (digits read vertically).

LISTING CF RECORDS FROM TAPE FILE

TAPE FILE NAME: SAO-UD-GC-DM CROSS INDEX

RECORDS 1 10 30

2
TAPPE FILE 3713 33VL

RECORD LENGTH 34 BYTES

INPUT VOLSER WHW034

C. I. N. D. E. X. H. I. X. N. N. G.

[illegible]

RECORD	1	1	225019 0	3D+82	740
RECORD	2	2	225020 0	4D+79	799
RECORD	3	3		8D+81	841
RECORD	4	4		8D+79	800
RECORD	5	5		8D+79	801
RECORD	6	6		8D+85	411
RECORD	7	7		8D+84	543
RECORD	8	8		8D+83	673
RECORD	9	9		8D+82	749
RECORD	10	10		8D+82	750
RECORD	11	11		8D+81	842
RECORD	12	12		8D+81	843
RECORD	13	13	56 0	8D+80	793
RECORD	14	14		8D+87	220
RECORD	15	15		8D+84	545
RECORD	16	16		8D+81	844
RECORD	17	17	174 0	8D+84	546
RECORD	18	18		8D+79	803
RECORD	19	19		8D+83	674
RECORD	20	20		8D+83	675
RECORD	21	21		8D+84	547
RECORD	22	22	245 0	118D+85	412
RECORD	23	23		8D+79	1
RECORD	24	24		8D+85	1
RECORD	25	25		8D+79	2
RECORD	26	26	486 0	8D+83	1
RECORD	27	27		8D+81	1
RECORD	28	28		8D+82	1
RECORD	29	29		8D+81	2
RECORD	30	30			

LISTING OF RECORDS FOR TAPE FILE

TAPE FILE NAME: SAO-11D-6C-DH Cross Index

REC'D 258968 TU 258997

TAPE FILE 2

RECORD LENGTH 34 BYTES

INPUT VOLSER WH-034

2
H
U
T
O
:

U
N
I
T
E
D
S
T
A
T
E
S
O
F
A
M
E
R
I
C
A

INDEX

[illegible]

REC'D 258968 258968 219358 0 32396CP-81 1029

REC'D 250969 250969 219598 0 CP-82 893

REC'D 258970 258970 219765 0 J2550CP-88 204

RECORD 258971 258971 CP-81 1033

REC'D 258972 258972 32610CP-88 206

REC'D 258973 258973 220522 0 32626CP-86 418

RECORD 258974 258974 220867 0 CP-83 749

REC'D 250975 258975 221214 0 12696CP-81 1036

RECORD 258976 258976 221510 0 CP-80 1071

RECORD	258977	258977	241911	0	CP-82	897
--------	--------	--------	--------	---	-------	-----

REC'D 258970 25897E 221763 0 328 27CP-47 319

RECORD 258979 250979 CP-85 557

REC'D 250980 222061 0 C.P-87 341

REC'D 258981 258981 222374 0 CP-81 1041

REC'D 258982 258982 222513 0 CP-83 755

4EC3D0 258981 256983 222669 0 32944CP-H3 756

REC'D 258984 223042 0 33008CP-84 658

RECORD 250985 258985 CP-82 903

REC'D 258906 223517 0 11083CP-80 1078

RECORD 258907 258987 CP-85 558

REC'D 25898 25886 CP-85 559

REC'D 258989 258989 223647 0 31107CP-82 905

REC'D 258990 221648 0 33115CP-86 423

REC'D 258991 271845 0 33142CP-81 1044

445050 258992 271813 0 33143CP-H3 758

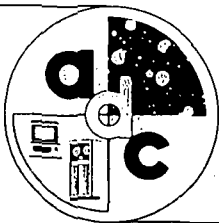
REC'D 258993 224030 0 CP-80 1079

LECCO 25092 25094 25095 25096 25097 25098 25099 25100 25101 25102 25103 25104 25105 25106 25107 25108 25109 25110 25111 25112 25113 25114 25115 25116 25117 25118 25119 25120 25121 25122 25123 25124 25125 25126 25127 25128 25129 25130 25131 25132 25133 25134 25135 25136 25137 25138 25139 25140 25141 25142 25143 25144 25145 25146 25147 25148 25149 25150 25151 25152 25153 25154 25155 25156 25157 25158 25159 25160 25161 25162 25163 25164 25165 25166 25167 25168 25169 25170 25171 25172 25173 25174 25175 25176 25177 25178 25179 25180 25181 25182 25183 25184 25185 25186 25187 25188 25189 25190 25191 25192 25193 25194 25195 25196 25197 25198 25199 25200 25201 25202 25203 25204 25205 25206 25207 25208 25209 25210 25211 25212 25213 25214 25215 25216 25217 25218 25219 25220 25221 25222 25223 25224 25225 25226 25227 25228 25229 25230 25231 25232 25233 25234 25235 25236 25237 25238 25239 25240 25241 25242 25243 25244 25245 25246 25247 25248 25249 25250 25251 25252 25253 25254 25255 25256 25257 25258 25259 25260 25261 25262 25263 25264 25265 25266 25267 25268 25269 25270 25271 25272 25273 25274 25275 25276 25277 25278 25279 25280 25281 25282 25283 25284 25285 25286 25287 25288 25289 25290 25291 25292 25293 25294 25295 25296 25297 25298 25299 25300 25301 25302 25303 25304 25305 25306 25307 25308 25309 25310 25311 25312 25313 25314 25315 25316 25317 25318 25319 25320 25321 25322 25323 25324 25325 25326 25327 25328 25329 25330 25331 25332 25333 25334 25335 25336 25337 25338 25339 25340 25341 25342 25343 25344 25345 25346 25347 25348 25349 25350 25351 25352 25353 25354 25355 25356 25357 25358 25359 25360 25361 25362 25363 25364 25365 25366 25367 25368 25369 25370 25371 25372 25373 25374 25375 25376 25377 25378 25379 25380 25381 25382 25383 25384 25385 25386 25387 25388 25389 25390 25391 25392 25393 25394 25395 25396 25397 25398 25399 25400 25401 25402 25403 25404 25405 25406 25407 25408 25409 25410 25411 25412 25413 25414 25415 25416 25417 25418 25419 25420 25421 25422 25423 25424 25425 25426 25427 25428 25429 25430 25431 25432 25433 25434 25435 25436 25437 25438 25439 25440 25441 25442 25443 25444 25445 25446 25447 25448 25449 25450 25451 25452 25453 25454 25455 25456 25457 25458 25459 25460 25461 25462 25463 25464 25465 25466 25467 25468 25469 25470 25471 25472 25473 25474 25475 25476 25477 25478 25479 25480 25481 25482 25483 25484 25485 25486 25487 25488 25489 25490 25491 25492 25493 25494 25495 25496 25497 25498 25499 25500 25501 25502 25503 25504 25505 25506 25507 25508 25509 25510 25511 25512 25513 25514 25515 25516 25517 25518 25519 25520 25521 25522 25523 25524 25525 25526 25527 25528 25529 25530 25531 25532 25533 25534 25535 25536 25537 25538 25539 25540 25541 25542 25543 25544 25545 25546 25547 25548 25549 25550 25551 25552 25553 25554 25555 25556 25557 25558 25559 25560 25561 25562 25563 25564 25565 25566 25567 25568 25569 25570 25571 25572 25573 25574 25575 25576 25577 25578 25579 25580 25581 25582 25583 25584 25585 25586 25587 25588 25589 25590 25591 25592 25593 25594 25595 25596 25597 25598 25599 25600 25601 25602 25603 25604 25605 25606 25607 25608 25609 25610 25611 25612 25613 25614 25615 25616 25617 25618 25619 25620 25621 25622 25623 25624 25625 25626 25627 25628 25629 25630 25631 25632 25633 25634 25635 25636 25637 25638 25639 25640 25641 25642 25643 25644 25645 25646 25647 25648 25649 25650 25651 25652 25653 25654 25655 25656 25657 25658 25659 25660 25661 25662 25663 25664 25665 25666 25667 25668 25669 25670 25671 25672 25673 25674 25675 25676 25677 25678 25679 25680 25681 25682 25683 25684 25685 25686 25687 25688 25689 25690 25691 25692 25693 25694 25695 25696 25697 25698 25699 25700 25701 25702 25703 25704 25705 25706 25707 25708 25709 25710 25711 25712 25713 25714 25715 25716 25717 25718 25719 25720 25721 25722 25723 25724 25725 25726 25727 25728 25729 25730 25731 25732 25733 25734 25735 25736 25737 25738 25739 25740 25741 25742 25743 25744 25745 25746 25747 25748 25749 25750 25751 25752 25753 25754 25755 25756 25757 25758 25759 25760 25761 25762 25763 25764 25765 25766 25767 25768 25769 25770 25771 25772 25773 2577

05895 256895 24154 0 CP-87 5/0

RECORD 258990 258996 224302 0 1121902-82 907

KECCKD 250997 250997 224867 0
CP-04 061



NASA

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771